

CLAIMS

What is claimed is:

[0051]

[Note: Bold-bracketed *and size-reduced cross-referencing text* (e.g. [100] is provided in the below claims as an aid for readability and for finding corresponding (but not limiting) examples of support in the specification. The bracketed text is not intended to add any limitation whatsoever to the claims and should be deleted in all legal interpretations of the claims and should also be deleted from the final published version of the claims.]

1. A polishing method comprising:

(a) supplying a first batch [210] of workpieces to a first CMP tool [230A]

for partly polishing the first batch with one or more silica (SiO₂) based chemical mechanical polishing slurries or equivalents; and

(b) forwarding the partly-polished first batch [214a] of workpieces to a second CMP tool [250] which uses ceria (CeO₂) based chemical mechanical polishing slurries or equivalents to further polish the batch of partly-polished workpieces.

2. The polishing method of Claim 1 and further comprising:

(c) completing the polishing of the partly-polished workpieces in the second CMP tool [250] so as to expose in each workpiece, a predefined and detectable surface level [113']; and

(d) using end-point detection [254] in the second CMP tool to determine when the predefined surface level [113'] of a given workpiece has

been exposed.

3. The polishing method of Claim 2 wherein said end-point detection [254] includes at least one of optical detection, force feedback detection, temperature detection, and chemical composition detection.

4. The polishing method of Claim 2 and further comprising:

(e) using time measurement [234] in the first CMP tool to determine when said partial polishing of each workpiece in the first batch should end.

5. The polishing method of Claim 4 and further comprising:

(e) shortening a time limit [T,234b] for said time measurement step in response to an indication that imminent use the first CMP tool is being requested for another batch of workpieces.

6. The polishing method of Claim 2 and further comprising:

(e) automatically adjusting [232b] polishing pressure [P] in said first CMP tool in response to an indication that workpieces in said supplied first batch [210] are to be only partly-polished.

7. The polishing method of Claim 2 and further comprising:

(e) automatically adjusting [232b] velocity [V] of a polishing pad in said first CMP tool in response to an indication that workpieces in said supplied

first batch [210] are to be only partly-polished.

8. The polishing method of Claim 2 and further comprising:

(e) automatically adjusting [232b] feed rate [F] of a slurry used by said first CMP tool in response to an indication that workpieces in said supplied first batch [210] are to be only partly-polished.

9. The polishing method of Claim 2 and further comprising:

(e) automatically changing [283] between use in said first CMP tool of a first slurry of respective first quality [Q1] and a second slurry of respective second and different quality [Q2] in response to an indication that workpieces in said supplied first batch [210] are to be only partly-polished.

10. A mass production facility [200] comprising:

(a) a plurality of different chemical mechanical polishing tools including:

(a.1) a first CMP tool [230A] which uses a corresponding one or more of first chemical mechanical polishing slurries to polish supplied batches [210,211] of workpieces, where the supplied workpieces each include at least first and second different materials, and where the first CMP slurries are characterized by one or both of:

(a.1a) relatively low-selectivity for removal of the first of said at least first and second different materials relative to removal of

the second of said materials; and

(a.1b) relatively poor ability to inherently drive the polishing process towards a high degree of planarity; and

(a.2) a second CMP tool [250] which uses a corresponding one or more of second chemical mechanical polishing slurries to polish input batches [205,216] of workpieces, where the input workpieces each include a plurality of different materials, and where the second CMP slurries are characterized by one or both of:

(a.1a) relatively high-selectivity for removal of the first of said at least first and second different materials relative to removal of the second of said materials, the high-selectivity being greater than said low-selectivity; and

(a.1b) relatively good ability to inherently drive the polishing process towards a high degree of planarity, the good ability being better than said relatively poor ability; and

(b) one or more workflow control computers [280] which include a workflow control program [285] that causes at least a first batch [210] of workpieces to flow through the first CMP tool for partial polishing therein and to subsequently flow through the second CMP tool for furtherance of said partial polishing in the second CMP tool.

11. The mass production facility [200] of Claim 10 and further

wherein said second chemical mechanical polishing slurries comprise ceria-based CMP slurries [241].

12. The mass production facility [200] of Claim 11 and further wherein said first chemical mechanical polishing slurries comprise silica-based CMP slurries [221].

13. The mass production facility [200] of Claim 10 and further wherein the workflow control program [285] causes the first CMP tool [230A] to terminate per-wafer polishing according to a time limit [T,234b] whose duration is automatically shortened in response to an indication that imminent use the first CMP tool is being requested for another batch of workpieces.

14. The mass production facility [200] of Claim 13 and further wherein the workflow control program [285] causes the second CMP tool [250] to terminate per-wafer polishing in accordance with an end-point detection algorithm [254] and the end-point detection algorithm is automatically modified [254b] in response to an indication that specifies whether workpieces of a flowing-through batch [205,206] are already partly-polished and are having such partial polishing continued by the second CMP tool or whether the flowing-through workpieces are not having an earlier performed, partial polishing continued by the second CMP tool.

15. The mass production facility [200] of Claim 10 and further wherein the workflow control program [285] causes said one or more workflow control computers to detect an indication that a multi-tool batch [201] is entering the first CMP tool [230A] and, in response, the program causes the first CMP tool [230A] to use a modified one or more settings for polishing pressure (P), pad velocity (V), slurry feed rate (F), and/or slurry quality (Q) which are different from normal settings which would otherwise be used in the first CMP tool for fully polishing away an upper material layer [112] of each wafer in a single-tool batch [202], where the modified one or more settings provide for faster and/or less planar and/or less precise and/or less costly polishing than would otherwise be provided by the normal settings of the first CMP tool for full polishing away of an upper material layer [112] of each wafer in the first CMP tool.

16. A manufacture [285] for conveying machine instructing signals for use in a mass production facility [200] where the facility has:

(0.1) a plurality of different chemical mechanical polishing tools including:

(0.1a) a first CMP tool [230A] which uses a corresponding one or more of first chemical mechanical polishing slurries to polish supplied batches [210,211] of workpieces, where the supplied workpieces each

include at least first and second different materials, and where the first CMP slurries are characterized by one or both of:

(0.1a1) relatively low-selectivity for removal of the first of said at least first and second different materials relative to removal of the second of said materials; and

(0.1a2) relatively poor ability to inherently drive the polishing process towards a high degree of planarity; and

(0.1b) a second CMP tool [250] which uses a corresponding one or more of second chemical mechanical polishing slurries to polish input batches [205,216] of workpieces, where the input workpieces each include a plurality of different materials, and where the second CMP slurries are characterized by one or both of:

(0.1b1) relatively high-selectivity for removal of the first of said at least first and second different materials relative to removal of the second of said materials, the high-selectivity being greater than said low-selectivity; and

(0.1b2) relatively good ability to inherently drive the polishing process towards a high degree of planarity, the good ability being better than said relatively poor ability; and

(0.2) workflow control means [280], responsive to said machine instructing signals [285] and able to automatically cause at least a first batch [210] of workpieces to flow through the first CMP tool for partial polishing therein and to subsequently flow through the second CMP tool for furtherance of said

partial polishing in the second CMP tool;

where the conveyed machine instructing signals comprise:

(a) a first instruction for causing detection of an indication that a supplied batch of workpieces is a multi-tool polish batch [201] rather than a one-tool polish batch [202]; and

(b) a second instruction for causing the first CMP tool [230A] to use a modified one or more settings for polishing pressure (P), pad velocity (V), slurry feed rate (F), and/or slurry quality (Q) which are different from normal settings which would otherwise be used in the first CMP tool for fully polishing away an upper material layer [112] of each wafer in a one-tool batch [202], where the modified one or more settings provide for faster and/or less planar and/or less precise and/or less costly polishing than would otherwise be provided by the normal settings of the first CMP tool for full polishing away of an upper material layer [112] of each wafer of a corresponding one-tool batch in the first CMP tool.

17. The instructions conveying manufacture [285] of Claim 16 and further comprising:

(c) a third instruction for causing the second CMP tool [250] to use a modified end point test [254b] different from a normal end point test which would otherwise be used in the second CMP tool for fully polishing away an upper material layer [112] of each wafer in a one-tool batch [202], where the

modified end point test compensates for the partial pre-polishing in the first CMP tool of each wafer of a corresponding multi-tool polish batch [201] .

18. A polishing method comprising:

(a) supplying a first batch [210] of workpieces to a first CMP tool [230A] for partly polishing the first batch with a corresponding one or more of first chemical mechanical polishing slurries, where the supplied workpieces of the first batch each include at least first and second different materials, and where the first CMP slurries are characterized by one or both of:

(a.1) relatively low-selectivity for removal of the first of said at least first and second different materials relative to removal of the second of said materials; and

(a.2) relatively poor ability to inherently drive the polishing process towards a high degree of planarity; and

(b) forwarding the partly-polished first batch [214a] of workpieces to a second CMP tool [250] which uses a corresponding one or more of second chemical mechanical polishing slurries, where the second CMP slurries are characterized by one or both of:

(b.1) relatively high-selectivity for removal of the first of said at least first and second different materials relative to removal of the second of said materials, the high-selectivity being greater than said low-selectivity; and

(b.2) relatively good ability to inherently drive the polishing process towards a high degree of planarity, the good ability being better than said relatively poor ability.

19. The polishing method of Claim 18 wherein said second chemical mechanical polishing slurries comprise ceria-based CMP slurries [241].

20. The polishing method of Claim 18 wherein said first chemical mechanical polishing slurries comprise silica-based CMP slurries [221].
